

supporting structures.

Moreover, a method is known by means of which the excavation faces are supported by steel sheet piles that are driven well below the maximum excavation depth, before performing said excavation, by means of vibration systems. This method sometimes cannot be applied, since the machines required for the installation are large and the vibrations produced during driving can damage nearby buildings.

Another known method for supporting the excavation face is constituted by the use of nails of different lengths, which are driven into the ground at right angles to the face directly after providing an excavation or a portion of an excavation. Said nails are adapted to increase the shear strength of the soil behind the face. However, in the time interval between execution of the excavation and nail driving, an unexpected instability may occur which can lead to the collapse of the face or of part of said face. In general, in any case, this method, known as "soil nailing", entails the use of large machines and high installation costs.

Another known method consists of injecting cement mixes into the soil proximate to the face to be provided, in order to increase the shear strength of the soil. This method, known as "jet grouting", requires high injection pressures (300-600 bar) for correct execution. These pressures may cause migration of the injected cement mixture into volumes of soil that are distant from the intended ones, causing considerable damage to nearby buildings. Moreover, this technology can be applied only to granular soil. These characteristics, together with high installation costs, limit considerably the application of this method in the urban environment.

Disclosure of the Invention

The aim of the present invention is to provide a method for increasing the resistance to all the various stresses of a portion (or band) of soil, particularly for containing and supporting excavation faces, that is capable of solving the problems noted above with reference to known types of

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In addition is also known providing a soil consolidation hole that is filled with foamed urethane. See in this respect Patent Abstract of Japan vol. 0180, no 44, 24 Jan. 1994 & JP 5 272126A (Okabe Co Ltd) and Patent Abstract of Japan vol. 0176, no. 67 (09.12.1993) & JP 5 222717 (Okabe Co Ltd).

Load bearing capacity increasing for subsided or loose soil masses by injection of expanding and hardening substances in holes made in the soil to be treated is described in EP-A-0 851 064, EP-A- 1 314 824 and GB 2 135 721 A.

Patent Abstracts of Japan vol. 0145, no. 19 (14.12.1990) & JP 2 217518 (Shimizu Corp.) describes a reinforcement technique based on application of a plastic material grid 5 supported on earth inserted bolts 4 and covered with mortar 6.

None of such documents regards an excavation face reinforcement method.